NWC

Roof

Asset

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Program

RAMP Energy Efficiency

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Kansas City Plant
Los Alamos National Lab
Lawrence Livermore National Lab
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Energy Efficiency
Current Guidelines

- ASHRAE 90.1
- Executive Order 13423
- National Energy Policy Act of 2005
- California Title 24
- International Energy Conservation Code (IECC)
- LEED

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Energy Efficiency
RAMP Current Practices

- Use of White/Light Capsheet for reflectivity/emissivity
- Use of White PVC/TPO for reflectivity/emissivity
- Proactive Repairs
  - Prevents wet insulation and reduced R-value
  - Extends roof life - delays landfill waste
- Double-layer insulation
  - Minimizes thermal transfer through joints
- Top layer adhered
  - Prevents thermal transfer from metal fasteners
- Polyisocyanurate (primary insulation)
  - Most thermally efficient available (6.00 R per inch) (LTTR)

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Energy Efficiency
Opportunities for Improvement

Not exactly what we mean by "Going Green"

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- Energy Efficiency
- Renewable Energy
- Sustainable Environmental Practices
- Hazardous Material Reduction

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Energy Efficiency

Policy:

(b) improve energy efficiency and reduce greenhouse gas emissions of the agency, through reduction of energy intensity by (i) 3 percent annually through the end of fiscal year 2015, or (ii) 30 percent by the end of fiscal year 2015, relative to the baseline of the agency's energy use in fiscal year 2003;

Means to achieve goals:

Increased R-Value

- Use of Polyisocyanurate Insulation (highest R-value/inch)
- Staggered Joints
- Upper layers adhered

Reflective/Light surfacing (Cool Roof)

- Use of white APP, PVC and TPO systems that meet cool roof criteria
- Light granular surfaces on modified bitumen roofs
- Gravel surfaced built-up roofs

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Renewable Energy

Policy:

(b) ensure that (i) at least half of the statutorily required renewable energy consumed by the agency in a fiscal year comes from new renewable sources, and (ii) to the extent feasible, the agency implements renewable energy generation projects on agency property for agency use;

Means to achieve goals:

Installation of energy producing roofing systems

- RAMP positioned to execute PV roof systems
- Building Integrated Photovoltaic (PV) systems

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Renewable Energy

Photovoltaic Roof Candidate List

Nevada Test Site	Pantex	LANL	LLNL
23-300	11-007	53-0001	671
23-111	12-042	55-0004	691
DAF	12-035	48-0001	571
C-3	12-066	33-114	191
A-1		33-019	

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Sustainable Environmental Practices

Policy:

(d) require in agency acquisitions of goods and services (i) use of sustainable environmental practices, including acquisition of bio-based, environmentally preferable, energy-efficient, water-efficient, and recycled-content products;

Means to achieve goals:

Specify use of energy efficient materials

- Polyisocyanurate Insulation (highest R-value/inch)
- Reflective/light surfacing – high emissivity (roofing and coatings)

Specify bio-based materials

- Coatings used to extend life (soy-based) and meet cool roof criteria
- Vegetative "Green" Roofs

Specify recyclable materials

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Hazardous Material Reduction

Policy:

(e) ensure that the agency (i) reduces the quantity of toxic and hazardous chemicals and materials acquired, used, or disposed of by the agency, (ii) increases diversion of solid waste as appropriate, and (iii) maintains cost-effective waste prevention and recycling programs in its facilities;

Means to achieve goals:

Life extending repairs

- Defers need for replacement and subsequent disposal

Specify cold-applied systems

- Eliminates hot tankers and fumes during application

New systems suitable for recovery upon expiration

- Recyclable roofing materials (membranes/flashings)

Method of insulation attachment allows for re-use in future

- Reduce landfill waste – reduce tear-off costs

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Energy Savings Recognized under RAMP

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Energy Efficiency – KCP Example

Pre-Replacement Example
KCP Area L004 – 5,658 SF
R-Value = 5.8

- Annual Heating Cost = $ 3,923
- Annual Cooling Cost = $ 353
- Total Annual Cost = $ 4,276

Post-Replacement Example
KCP Area L004 – 5,658 SF
R-Value = 16.5

- Annual Heating Cost = $ 1,347
- Annual Cooling Cost = $ 127
- Total Annual Cost = $ 1,474

Savings realized through roof replacement:

Pre-replacement Energy Costs = $ 4,276
Post-replacement Energy Costs = $ 1,474
Annual Energy Cost Savings = $ 2,802

- 66% Reduction in Annual Energy Costs in this example

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Roof Asset Management Program Energy Savings

Replaced roof sections have snow, while original construction does not - days after a snow storm

LANL Roof Area

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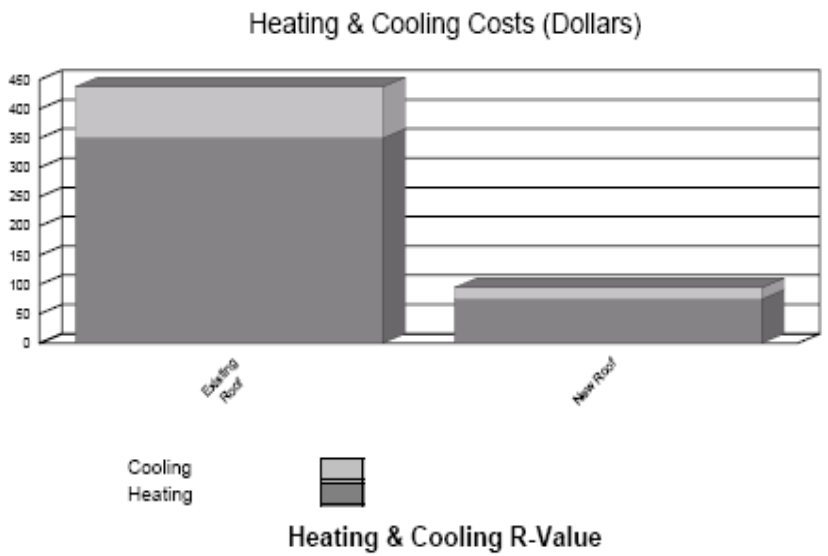
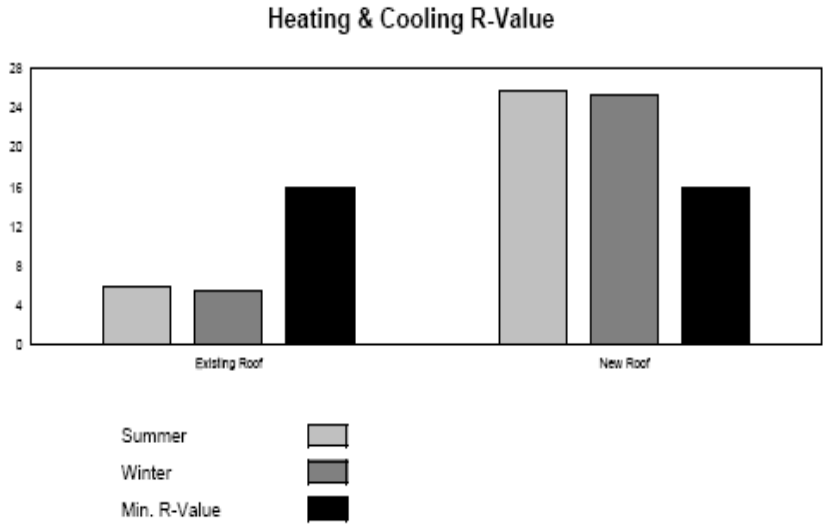
Los Alamos Building 48-0001 Roof Area N



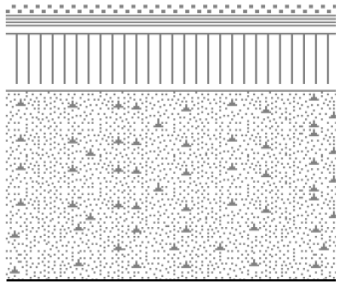


Existing Roof

System Description	R-Values		Annual Costs	
Existing Roof	Heating:	5.45	Heating:	$349.96
	Cooling:	5.84	Cooling:	$88.03
	Minimum (ASHRAE 90.1-99)	15.87	Total:	$437.99

Roof Reflectivity: N/A

Layer Type and Material	Thickness	R Value
Built-up membrane (aggregate surfaced)	N/A	0.33
Glass fiber, 1-1/16 in. thick (top-side faced)	1.062	4.17
Normalweight struct.concrete (150 lbs/ft³ density)	3.5	0.17

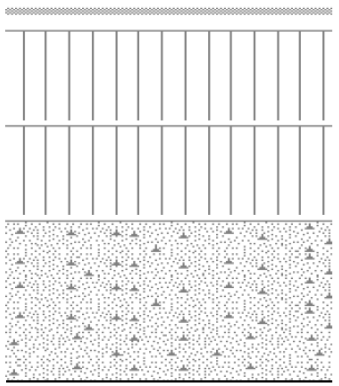


New Roof

System Description	R-Values		Annual Costs	
New Roof	Heating:	25.39	Heating:	$75.12
	Cooling:	25.78	Cooling:	$19.94
	Minimum (ASHRAE 90.1-99)	15.87	Total:	$95.06

Roof Reflectivity: N/A

Layer Type and Material	Thickness	R Value
CSPE (unsurfaced:min.reflect.= .70, min.emit.=.7	N/A	0.24
Polyisocyanurate, 2.0 in. thick (faced) [LTTR]	2	12.10
Polyisocyanurate, 2.0 in. thick (faced) [LTTR]	2	12.10
Normalweight struct.concrete (150 lbs/ft³ density)	3.5	0.17



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Complex Wide - Weighted R-Value

2007 Roof Replacements:		
Pre-replacement R-Value	8.12	
Post-replacement R-Value	23.77	
Increase in R-Value	15.65	***193%***
2008 Roof Replacements:		
Pre-replacement R-Value	8.94	
Post-replacement R-Value	21.37	
Increase in R-Value	12.43	***139%***

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Energy Efficiency

2005-2010 Reduction in Energy Costs

Site	SF	Cost Before Replacement	Cost After Replacement	Annual Savings	20-Year Savings
KCP	336,867	$ 180,525	$ 68,573	$ 111,952	$ 2,239,040
LANL	723,372	$ 173,226	$ 47,729	$ 125,497	$ 2,509,940
LLNL	149,455	$ 19,607	$ 6,895	$ 12,712	$ 254,240
NTS	283,594	$ 227,137	$ 51,164	$ 175,973	$ 3,519,460
PTX	376,747	$ 92,577	$ 27,661	$ 64,916	$ 1,298,320
SNLL	24,149	$ 1,193	$ 749	$ 444	$ 8,880
Y-12	544,678	$ 124,362	$ 44,678	$ 79,684	$ 1,593,680
Total	2,438,862	$ 818,627	$ 247,449	$ 571,178	$ 11,423,560

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EnergyWise, a savings calculator jointly developed by ORNL and the National Roofing Contractors Association (NRCA), was used to develop the cost savings. The basis of savings is developed by establishing the R-Value of the systems before and after replacement. Site specific utility costs are captured along with the region specific heating/cooling days for use in generating the results.